NSF Division of Astronomical Sciences (AST)
AAS Town Hall
January 4, 2017

Jim Ulvestad, Division Director

Ralph Gaume, Deputy Division Director

MPS/AST

Outline

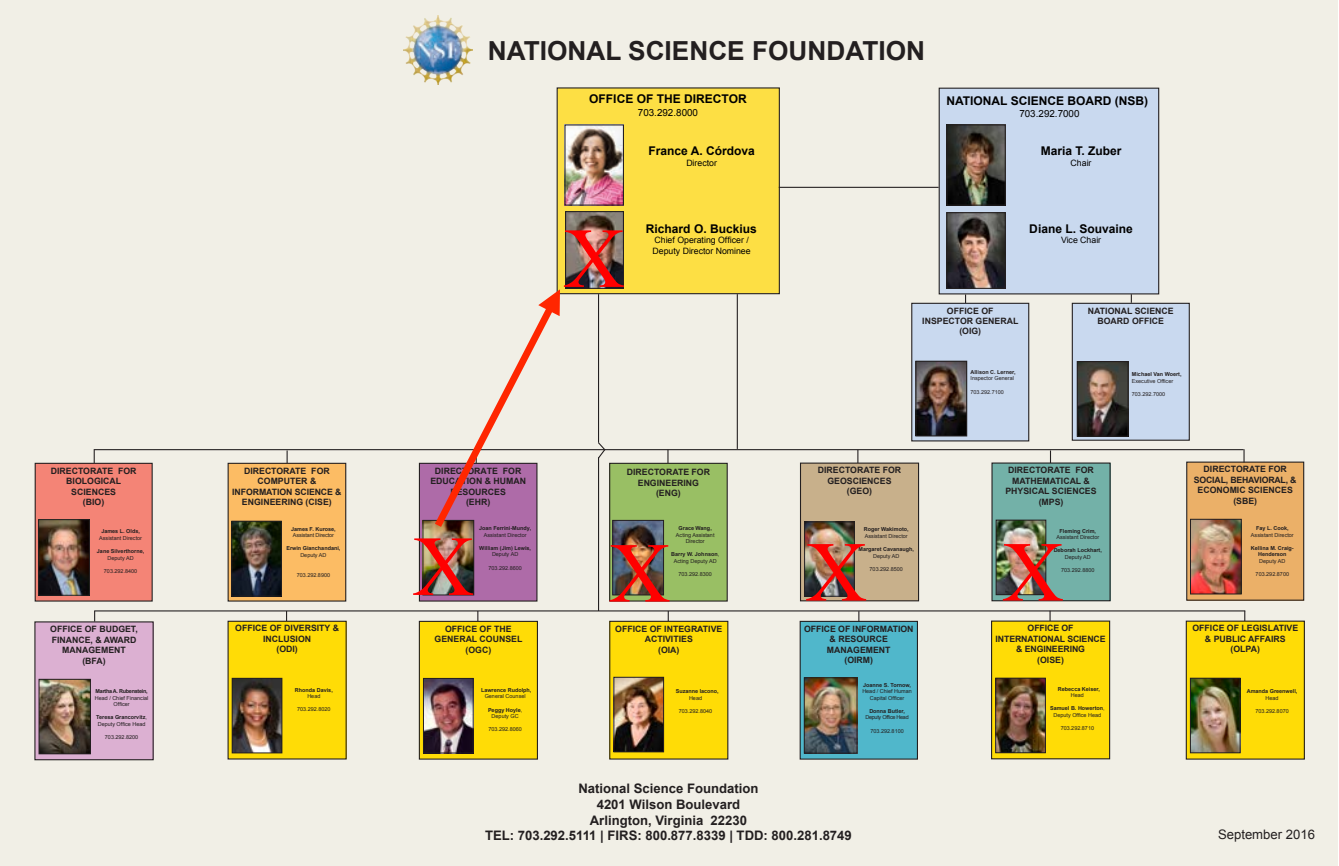
- NSF Context (Jim)
- AST Staff Introductions (Ralph)
- Science and Facility Highlights (Ralph)
- Individual Investigator Programs (Ralph)
- AST Budget Outlook (Ralph)
- Divestment and Environmental Reviews (Ralph)
- Recent Community Reports (Jim)

Transitions: AST and MPS

- Ralph Gaume became Deputy Division Director in Nov. 2016
- NSF has opened search for a new Division Director, to replace current Division Director (Ulvestad) in autumn 2017
- Recruitment committee in place to help identify candidates
  - Roger Blandford, Joel Bregman, Debra Elmegreen, Lyman Page, Caty Pilachowski.
  - Application period closes January 20.
- Near-term changes
  - NSF Assistant Director (AD) overseeing Directorate for Mathematical and Physical Sciences (MPS), Fleming Crim, will complete his 4-yr term on January 13, 2017.
  - Jim Ulvestad will become Acting AD for MPS
  - Ralph Gaume will become Acting Division Director for AST

Transitions: NSF

- Major NSF leadership transition
- January 2017: New Acting ADs for MPS, ENG
- February 2017 New Acting ADs for EHR, GEO, and new Acting Chief Operating Officer



Transitions: President & Congress

- Topics discussed frequently with respect to transition
  - Discretionary spending: military and non-military
  - Potential infrastructure investments
  - Globalization, American competitiveness, and jobs
  - Immigration policies
  - Supreme Court
  - Energy and climate change
  - “Epidemics”: Opioid, Zika, terrorism
- Not a lot of discussion about long-term investment in science and innovation, outside the scientific community
- NSF has no inside knowledge about priorities and directions after January 20.

New NSF Authorization Bill

- "American Innovation and Competitiveness Act" passed Congress in December 2016.
  - Awards should be in the national interest—tied to Broader Impacts review criterion
  - No funding levels specified for NSF as a whole, or for individual Directorates
  - Considerable direction regarding facility oversight
- See FYI #150 at www.aip.org/fyi

Budgets for NSF and AST

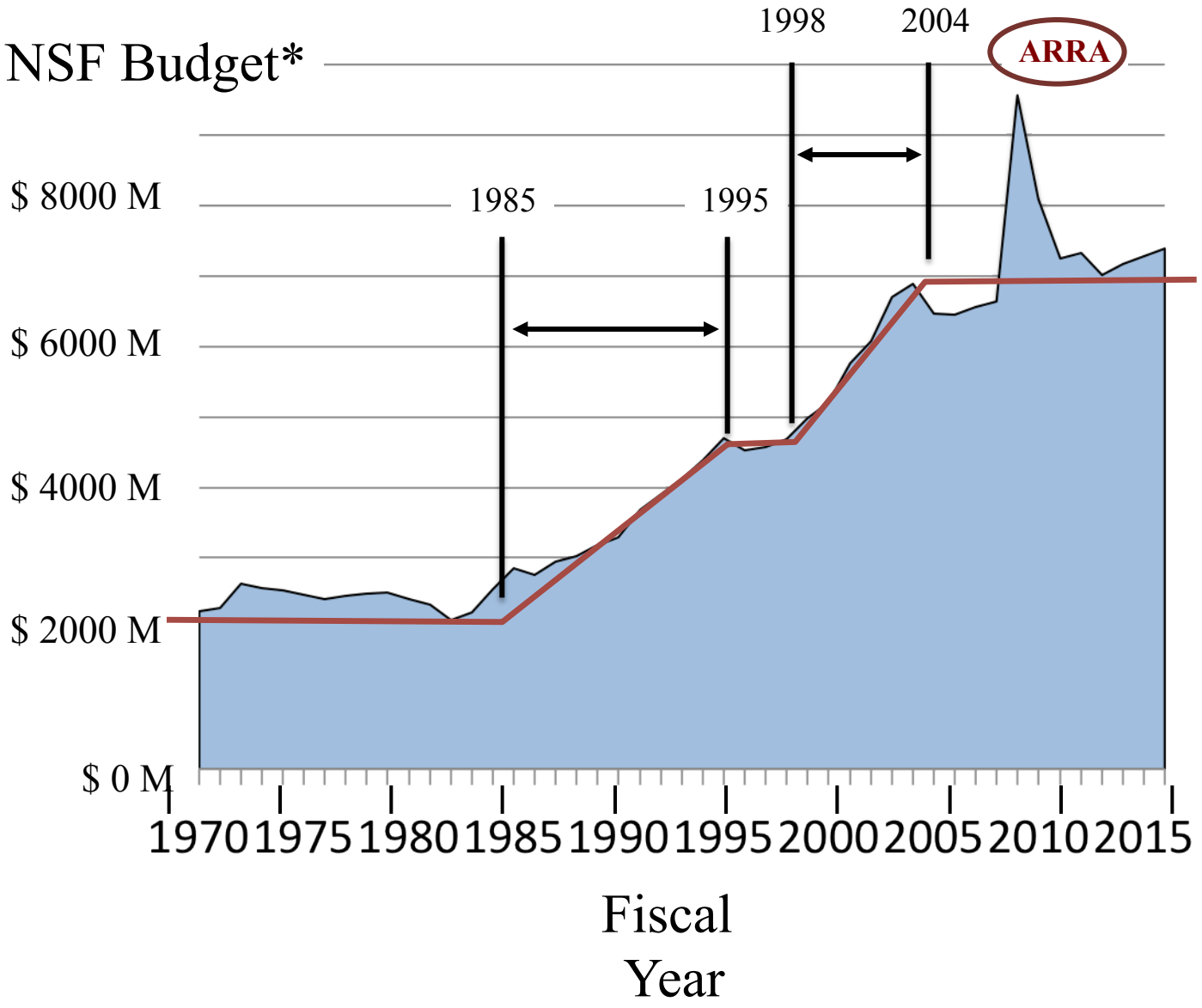
- FY 2017 Continuing Resolution (CR) through April 28, 2017.
- FY 2017 is end of two-year deal on discretionary spending.
- Two (of many) possible FY 2017 budget outcomes
  - Year-long CR or flat budget with respect to FY 2016?
  - Re-balance military/domestic discretionary spending?
- Sequestration scheduled to return in FY 2018.

- FY 2018 President's Budget Request is uncertain.

FY 2017 Budget Request--AST

$M	FY15 Actual	FY16 Request	FY16 Actual	FY17 Request Disc.
NSF Total	7344	7724	7464	7564
NSF R&RA	5934	6186	6034	6079
MPS	1337	1366	1349	1355
AST	245.2	246.5	246.4	247.7
MREFC	200.8	200.3	200.3	193.1

NSF Funding History



*Constant 2014$

NSF Big Ideas

RESEARCH IDEAS

Harnessing Data for 21st Century Science and Engineering

Work at the Human-Technology Frontier: Shaping the Future

Navigating the New Arctic

Windows on the Universe: The Era of Multi-messenger Astrophysics

The Quantum Leap: Leading the Next Quantum Revolution

Understanding the Rules of Life: Predicting Phenotype

PROCESS IDEAS

Mid-scale Research Infrastructure

NSF 2050: Seeding Innovation

Growing Convergent Research at NSF

NSF INCLUDES: Enhancing Science and Engineering through Diversity

Facility/Divestment Recommendations

- NSF policy: 22-27% of budget in Research Infrastructure
- Flat budgets stress facility-heavy Divisions
- MPS/AST Portfolio Review–August 2012
  - Divest lower priority facilities
- GEO/OCE (Ocean Sciences) *Sea Change* report—Jan. 2015
  - Recommendation 3: "OCE should initiate an immediate 10% reduction in major infrastructure costs in its next budget, followed by an additional 10-20% decrease over the following 5 years."
- GEO/AGS (Atmospheric and Geospace Sciences) review of Geospace Section portfolio—April 2016
  - Reduce facilities investments by 10% to open wedge for decadal survey recommendations (includes 73% Arecibo reduction)

AST Staffing
and
New Location

Division of Astronomical Sciences (AST)

Office of the Division Director

Ralph Gaume
Acting Division Director

Edward Ajhar
Acting Deputy Division Director

Craig McClure
Program Support Manager

Donna O'Malley
Financial & Operations Specialist

Vernon Pankonin
Senior Advisor

Elizabeth Pentecost
Project Administrator

Administration

Allison Farrow
Program Specialist

Stephanie Hill
Program Assistant (Student)

Diana Phan
Program Analyst

Matthew Viau
Program Specialist

Individual Investigator Programs and Astronomy & Astrophysics Research Grants

James Neff
Program Director
IIP Coordinator; Education & Special Programs (REU, PAARE)

Richard Barvainis
Program Director
Extragalactic Astronomy & Cosmology

Glen Langston
Program Director
Galactic Astronomy

Harshal Gupta
Program Director
Astronomy & Astrophysics Postdoctoral Fellowships

Joan Wrobel
Program Director
CAREER; Extragalactic Astronomy & Cosmology

Faith Vilas
Program Director
Solar and Planetary Research Grants

Hans Krimm
Program Director
Stellar Astronomy & Astrophysics

Peter Kurczynski
Program Director
Advanced Technologies & Instrumentation, Major Research Instrumentation

Linda French
(January 2017)

Facilities, Mid-Scale, & MREFC Projects

Christopher Davis
Program Director
Gemini Observatory

Philip Puxley
Program Director
National Radio Astronomy Observatory

David Boboltz
Program Director
National Solar Observatory

Nigel Sharp
Program Director
Large Synoptic Survey Telescope

Edward Ajhar
Program Director
Green Bank Observatory, Long Baseline Observatory

Joe Pesce
Program Director
Arecibo Observatory

Vernon Pankonin
National Optical Astronomy Observatory

Richard Barvainis
Mid-Scale Innovations Program

Philip Puxley
Atacama Large Millimeter Array

ESM

Thomas Wilson
Program Director

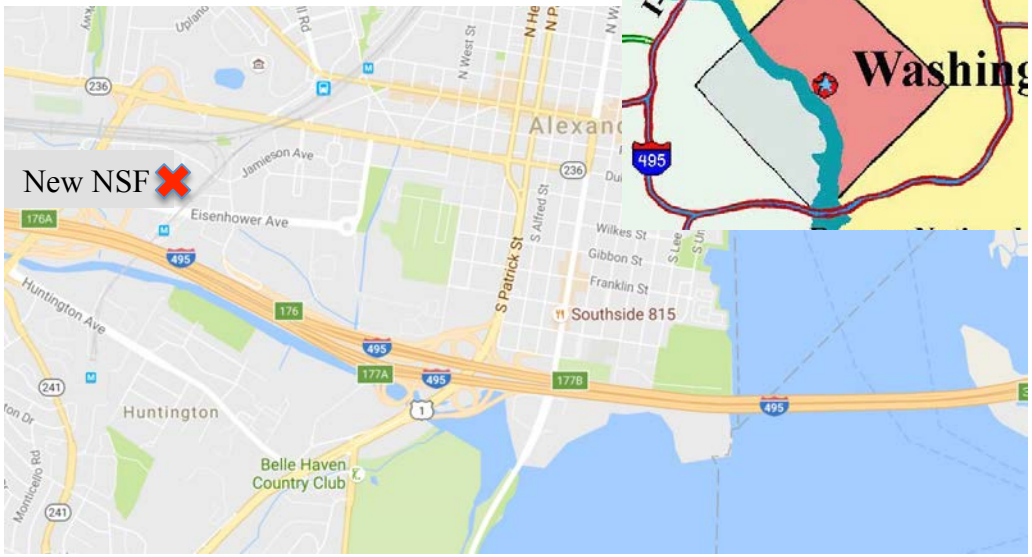
Joe Pesce
Program Director

NST/AST Jobs

- AST Division Director
  - Closes January 20th
- AST Program Director
  - Permanent Federal Employee
  - Closes January 9th
- Both jobs listed on usajobs.gov
  - Keywords: NSF, Astronomical
- AST Rotators, Intergovernmental Personnel Act (IPA)
  - Open until filled, Google: NSF AST 17-001
    - AST Dear Colleague Letter (AST-17-001)

NSF is Moving!

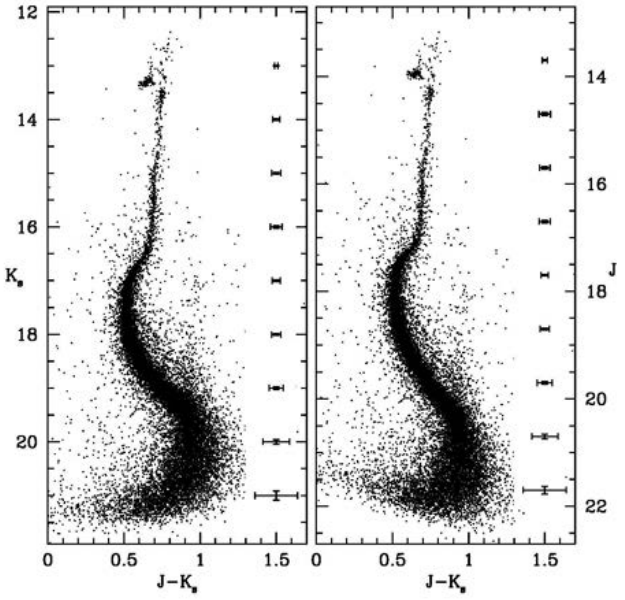
- NSF will move from its current location in Arlington, Virginia to a location in Alexandria, Virginia in July-September 2017.
- The Directorate for Mathematical and Physical Sciences, including AST, is scheduled to move over an extended Labor Day weekend in August/September.



A Few Highlights

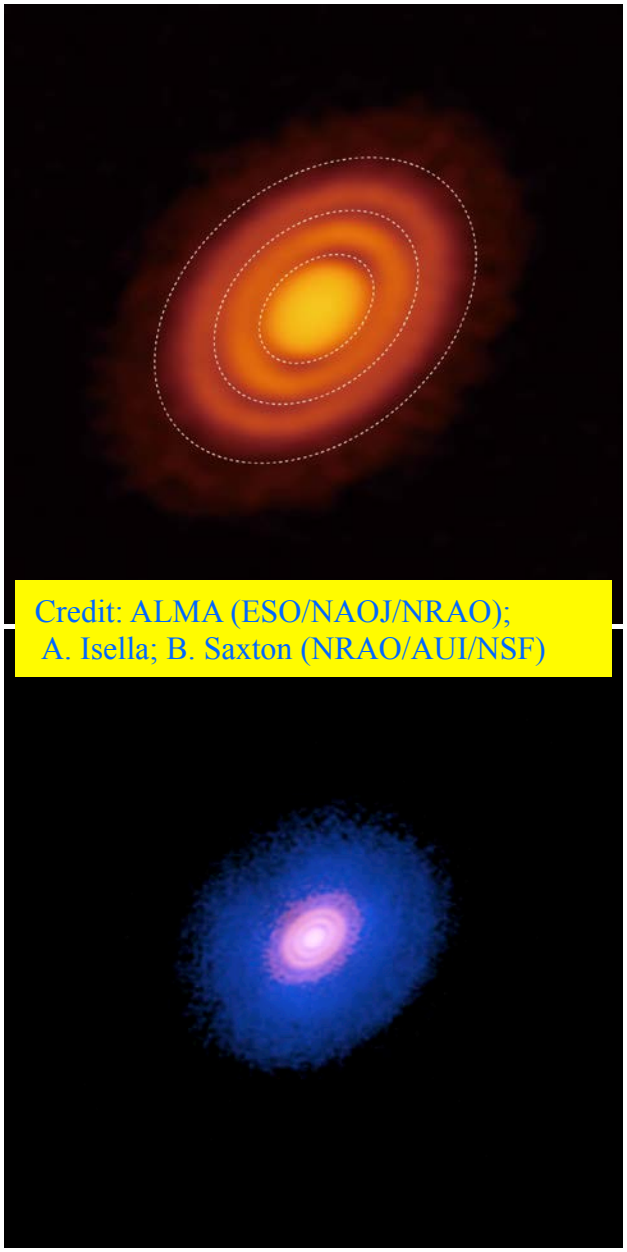
Gemini: NGC 6624

- Gemini: GeMS + GSAOI
- Bulge globular cluster NGC 6624 imaged in near-IR with 0.08-arcsec imaging over 93-arcsec field.
- Detected main-sequence “knee,” found age of 12.0 +/- 0.5 Gyr, and detected mass segregation, with increased fraction of low-mass stars with increasing distance from core.
- Saracino et al. 2016 (ApJ 832, 1).



ALMA: HD 163296

- ALMA observed both (1.3mm) dust and gas (^{12}CO, ^{13}CO, C^{18})
- Three gaps observed in dust ring:
  - At 60, 100, 160 AU
- Disk composed of ~1% dust and 99% gas, critical to observe gas.
- 2nd and 3rd ring depleted in both gas and dust, attributed to potential Saturn mass planets.
- 1st ring depleted in dust, but not gas, likely non-planetary process.
- Isella et al., 2016 (Phys. Rev. Lett. 117, 25)



Credit: ALMA (ESO/NAOJ/NRAO); A. Isella; B. Saxton (NRAO/AUI/NSF)

Arecibo, VLA, VLBA, Gemini: FRB 121102

- Fast Radio Bursts (FRB) are (1-10) millisecond radio pulses of astronomical origin, discovered 2007
- FRB 121102 discovered at Arecibo Observatory during Pulsar ALFA survey
  - Follow up subsequently discovered 10 additional bursts.
- Spitler et al., 2016, (Nature 531, 7593)
- AAS press conference *today*!
- VLA localized the position, and discovered persistent component
- VLBI established coincidence of burst and persistent sources (within 100 ly)
- Gemini N observations have associated the position with a dwarf galaxy

Credit: Danielle Futselaar

Daniel K. Inouye Solar Telescope (DKIST)

- DKIST will be a 4.2-meter solar telescope to study the Sun at the fundamental 20-km scale of the solar magnetic structures.
- Completion in FY 2020 at Haleakala Observatory (Maui).
- Hawaii Supreme Court affirmed construction permit (Oct. 6)
- Top: Artist's view of DKIST enclosure with cutaway
- Bottom: Base ring of Telescope Mount Assembly (right) inside the DKIST enclosure (left).

Large Synoptic Survey Telescope

- 10 year survey of 10s of billions of objects in space and time
- F1.2, 8.4m primary, FOV 3.5d (9.6 sq d)
- 3.2 Gpixel camera, 2 sec readout, ~15 TB per night
- 825 visits per pointing (main survey = 18,000 sq d)
- ~10 M alerts per night, 60 sec latency
- Construction progressing, late 2022 start date for survey.

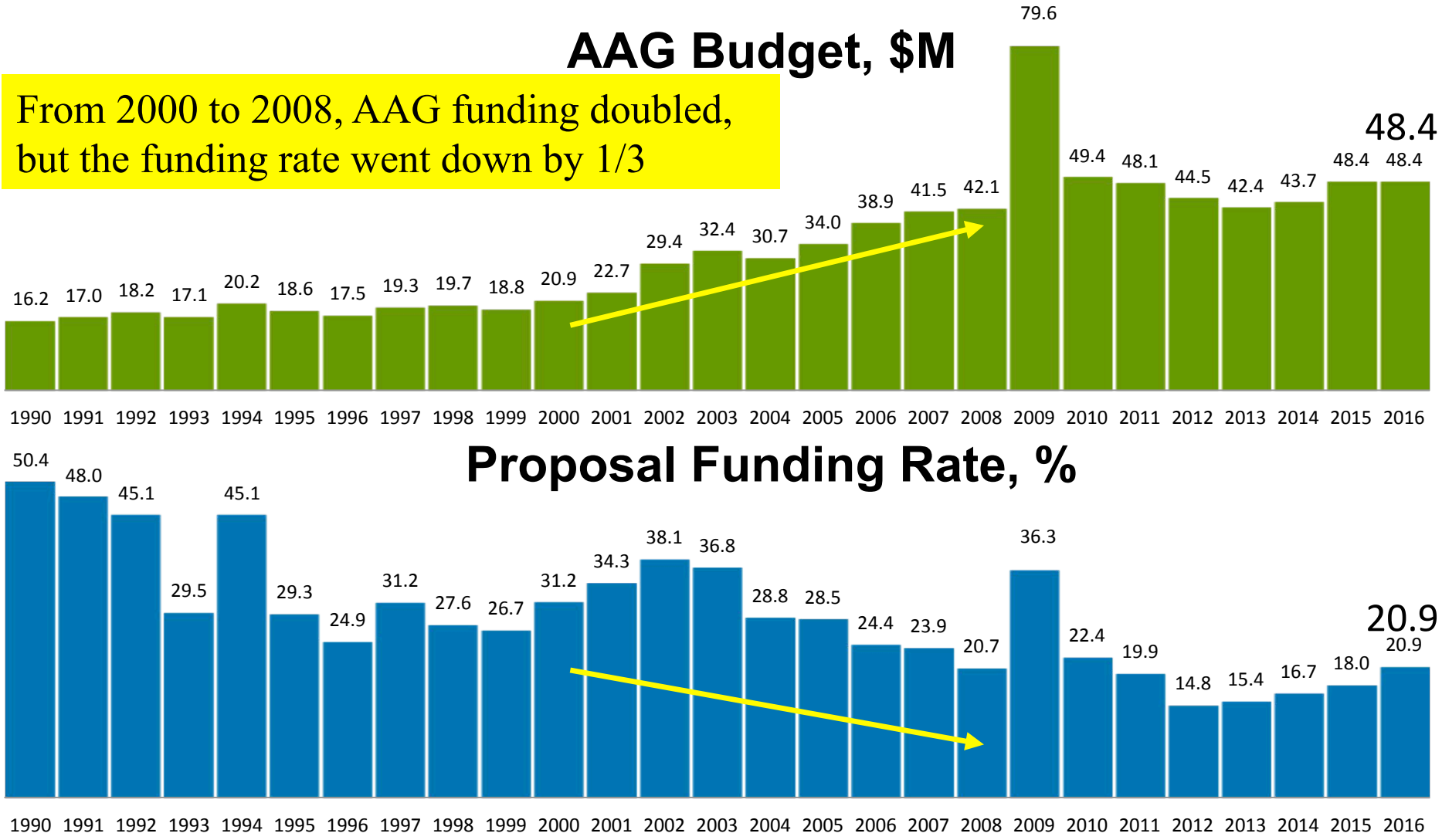
Recent construction image

… compared to artist's impression

NSF AST Individual Investigator Program

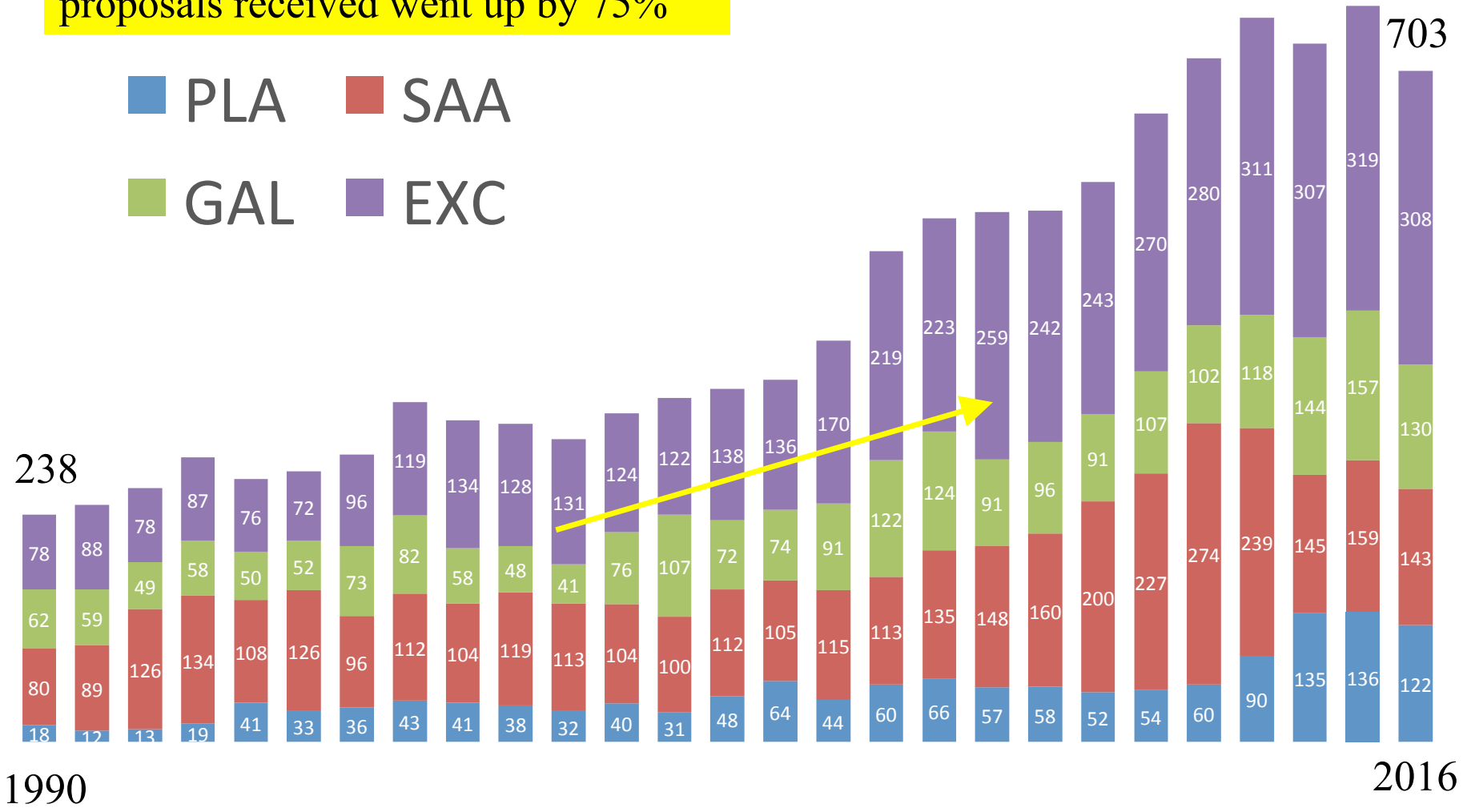
AAG Funding History, 1990-2016

From 2000 to 2008, AAG funding doubled, but the funding rate went down by 1/3



Proposals in AAG, 1990-2016

From 2000 to 2008, the number of proposals received went up by 75%



Changes in AST AAG Program for FY 2017

- In FY 2017, AST is running a pilot program with NO PROPOSAL DEADLINE for the Planetary/Exoplanetary and Solar portions of the Astronomy and Astrophysics Research Grants (AAG) program.
  - Solicitation NSF 16-602: Solar and Planetary Research Grants (SPG).
  - Declined proposals may not be resubmitted for 12 months after initial submission.
- The rest of AAG is running as before, November 15, 2016 proposal deadline (Solicitation 16-574).
- Budget breakdowns between AAG and SPG are expected to remain similar to FY 2016.

Other Individual Investigator News

- CAREER, AAPF, and REU programs have remained fairly stable in funding for a number of years
- Advanced Technologies and Instrumentation (ATI) has been reduced somewhat over the past several years.
- Partnerships in Astronomy and Astrophysics Research and Education (PAARE) is currently running every other year.
  - AST to conduct an analysis of this program to see whether it should be continued in its current form.

AST Budget

FY 2017 Budget

$M	FY15 Funding	FY16 Funding	FY17 Pres. Budget
AST Total	245.2	246.4	247.7
Facility Operations	148.4	149.1	155.2
AAG+ATI	56.6	57.4	51.4
Education/CAREER	10.1	10.5	10.9
MSIP	13.0	19.3	18.0
Other (mostly grants)	17.1	10.1	12.2
MREFC	104.8	113.0	87.1

AST Budget Pressures

- Must plan for possibility of no budget increases for the balance of the decade
- Need to balance facilities, small and mid-scale programs and individual investigator grants
- Mid-decadal survey report stated:

  "The LSST operations cost of $8 million at first, growing to $25 million, will be an additional burden on the AST budget in the first half of the next decade. The committee strongly supports the goal of a balanced program that includes facilities, medium scale initiatives, and small-scale initiatives. Maintaining this balance is a challenge at the current level of funding."

Transitions and Divestment

Transitions in AST Techniques

- Solar physics
  - DKIST is the first new AST solar observatory since ~1970.
  - Moving to combination of routine solar disk monitoring with investigations at fundamental length scale on Sun
- Night-time OIR astronomy
  - Concluding transition from era of multi-user 2-4m telescopes
  - Multi-user 6-10m telescopes, plus telescopes primarily dedicated to one or a few large projects and data sets
- Radio astronomy
  - Concluding transition from single-dish telescopes with limited angular resolution to versatile interferometers with arcsecond and subarcsecond imaging capability
- Each transition takes decades to occur
- Transitions track science and facility recommendations in decadal surveys

AST Facility Portfolio

- Portfolio Review Committee was commissioned in 2011 as broadly representative subcommittee of MPS Advisory Committee
- Portfolio Review Committee reported out in August 2012
  - Recommended a balance of small, medium and large programs that would require divestment of a number of operating telescopes from AST budget
- In 2016, both the Astronomy and Astrophysics Advisory Committee (AAAC) and the National Academies Midterm Assessment of the decadal survey recommended (using the words of the AAAC) that "Strong efforts by NSF for facility divestment should continue as fast as is practical."

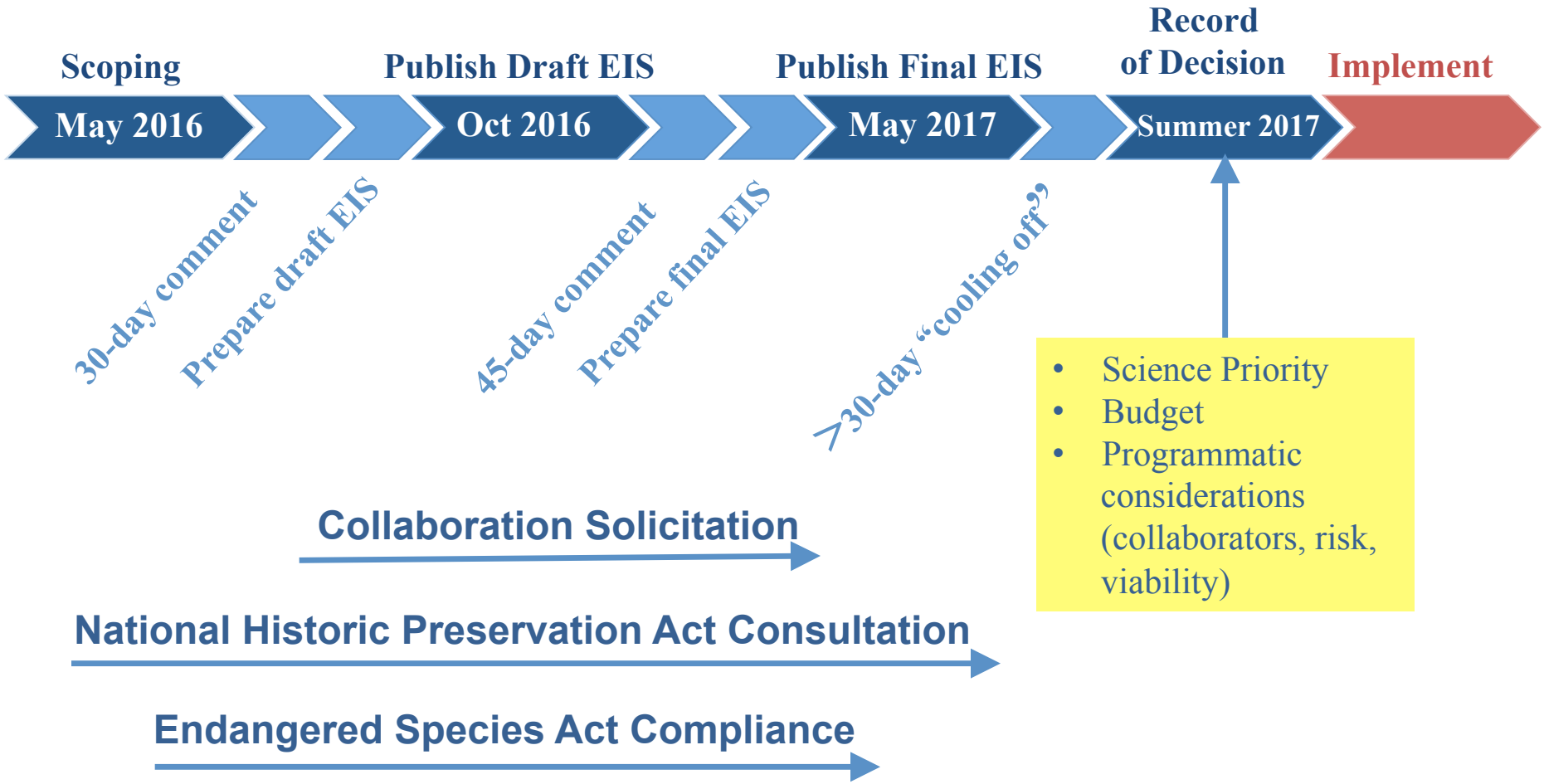
What Does "Divestment" Mean?

- The recommendations of the Portfolio Review Committee solely referred to removal of the funding of telescopes from the NSF/AST budget.
- Telescopes recommended for divestment are still important, and in some cases unique assets for astronomical research or other related uses.
- Hence the preferred divestment alternative, pursued vigorously by NSF since 2012, has been to find funding collaborations that enable some continued availability of NSF telescope assets for the research community.

Divestment Summary
(as of November 5, 2016)

Telescope	Status
KPNO 2.1m	Caltech-led consortium (Robo-AO) operating for FY 2016-2018.
Mayall 4m	Slated for DESI; bridge from NSF to DOE; NSF/DOE MOU for transition.
WIYN 3.5m	NOAO share to NASA-NSF Exoplanet Observational Research Program; NSF/NASA MOU in place; NASA instrument selected.
GBO	Separation from NRAO in FY 2017; ~25% collaboration for basic scope; started Environmental Impact Statement (EIS) process on October 19.
LBO/VLBA	Separation from NRAO in FY 2017; MOA with US Navy in place for 50%.
McMath-Pierce	No obvious partner opportunities; very small user community.
GONG/SOLIS	SOLIS is off Kitt Peak; GONG refurbishment; Interagency Agreement with NOAA signed (NOAA sharing GONG operations costs).
Sacramento Pk.	University consortium in development, and NSF funded NMSU for transition to consortium; started EIS process; completion in 2017.
Arecibo	Formal EIS process under way, and issuance of Record of Decision targeted for 2017. Draft EIS released October 28.
SOAR	Post-2020 status to be reviewed.

Target Dates for Arecibo Environmental Impact Statement (EIS)



Sac Peak and Green Bank are on similar paths, 2-6 months behind Arecibo.

NSF-Associated Town Halls

- Wednesday:
  - NSF Town Hall (but you knew that already)
  - LSST Town Hall: 7:30p, Grapevine A
- Thursday:
  - Gemini Observatory Open House: 6:30p, Texas 4
- Friday:
  - NOAO Forward: 12:45p, Texas C
  - 2017 NSF Astronomy and Astrophysics Postdoctoral Fellows Showcase and Forum, 6:30, Texas C
  - NRAO Town Hall: 6:30, Grapevine C

Recent Community Reports

Elmegreen OIR Report

- April 2015: National Academies delivered report on "Optimizing the U.S. Ground-Based Optical and Infrared Astronomy System" (aka Elmegreen report).
  - Report made prioritized recommendations, but did not attempt to provide details of instrument requirements (see Kavli Futures Symposium).
- Overall NSF response published in Dear Colleague Letter NSF 15-115.
- Several recommendations related to NOAO fostering of community, which go well beyond base scope funded by NOAO; under discussion/development with NOAO.

LSST/NOAO Symposium Report

- August 2015: NSF wrote to the AURA President and the LSST and NOAO Directors requesting consideration and prioritization of specific technical capabilities for the US Optical/Infrared Telescope System that are required to fully realize LSST-enabled science, using 6-8 representative science cases.

- October 2016: Report of the Kavli Futures Symposium "Maximizing Science in the Era of LSST: A Community-Based Study of Needed US OIR Capabilities".
  - Considered six baseline science cases, and addressed prioritized needs and prospects for specific instrumental capabilities needed to address those science cases.

National Center for Night-time OIR Astronomy

- Numerous recommendations regarding enhanced coordination among NSF OIR observatories.
- September 2016: After many discussions with AURA management and Observatory leadership, NSF provided guidance to AURA on planning a National Center.
  - Purpose, mission and scope of a single administrative organization to coordinate resources among LSST operations, Gemini Observatory, and continuing NOAO programs.
  - AURA is to deliver to NSF a proposed plan for this National Center, with a targeted delivery date of mid-2017.
  - Separately, the potential National Center is being discussed with Gemini, LSST, and NOAO partners.
- The overall benefit envisioned is the provision of enhanced science return through coordination of capabilities as LSST moves toward operations.

2016 AAAC and Mid-Decadal-1

- *March 2016 AAAC Recommendation: "We urge that full programmatic funding required by the three agencies to execute their FY 2017 plans, as described in their budget requests, be provided."*

- *August 2016 NAS Mid-Decadal Review Recommendation 3-2: "The NSF and the National Science Board should consider actions that would preserve the ability of the astronomical community to fully exploit the Foundation's capital investments in ALMA, DKIST, LSST, and other facilities. Without such action, the community will be unable to do so because at current budget levels the anticipated facilities operations costs are not consistent with the program balance that ensures scientific productivity."*

2016 AAAC and Mid-Decadal-2

- *March 2016 AAAAC Recommendation: "Strong efforts by NSF for facility divestment should continue as fast as is practical. Efforts to explore partnerships, interagency cooperation and private resources to maintain some access to facilities for the US community that may mitigate the loss of open access should continue. Transferring the cost of operating a facility outside of the NSF/AST budget is preferable to complete loss of a capability from the suite of capabilities used by US researchers."*

- *August 2016 NAS Mid-decadal review Recommendation 3-1: "National Science Foundation (NSF) should proceed with divestment from ground-based facilities which have a lower scientific impact, implementing the recommendations of the NSF [AST] Portfolio Review, that is essential to sustaining the scientific vitality of the U.S. ground-based astronomy program as new facilities come into operation."*

2016 AAAC Recommendation and CMB-S4

- *<u>Recommendation</u>: "We encourage DOE, NSF, and university community to continue working toward a plan for a future (Stage 4) ground-based CMB experiment."*

- Response: NSF (AST, PHY, PLR) and DOE/HEP are actively coordinating and working with the science community.
- In October 2016, NSF and DOE charged AAAC to form a subcommittee to develop a strawman project concept that can be used for agencies' planning purposes. Charles Lawrence (JPL) has agreed to chair this committee.
- The P5 committee recommended CMB-S4 as a strategic initiative, but this was not an *NWNH* recommendation. NSF currently plans to evaluate CMB-S4 funding within established core programs.